

## 1 ABSTRACT

2 The present invention applies to resonant optical power control device assemblies and  
3 methods relating thereto, and includes an alignment device preferably including one or more  
4 waveguide-alignment grooves, resonator alignment grooves, and alignment grooves for a second  
5 optical element including a modulator. One embodiment includes a transmission optical  
6 waveguide, a circumferential-mode optical resonator; and a second optical element, optionally  
7 including one or more of an optical modulator or a second transmission optical waveguide, and  
8 optionally including a modulator optical control element. In this embodiment, the alignment  
9 grooves reliably establish and stably maintain evanescent optical coupling between the optical  
10 elements positioned in such grooves. A method for assembling a resonant optical power control  
11 devices is also disclosed. The method includes: fabricating an alignment substrate having  
12 various alignment grooves; positioning and securing the various optical elements in their  
13 corresponding alignment grooves so that the resonator and the transmission optical waveguide  
14 are optically coupled (through close proximity and/or direct contact between them), and similarly  
15 optically coupling the resonator and any second optical element. Alignment grooves in the  
16 substrate and/or in one or more of the optical elements are fabricated at proper depths and  
17 positions and preferably with mating grooves and/or flanges to enable the optical coupling  
18 without extensive active alignment procedures. A modulator can alternatively be provided as an  
19 integral component of the resonator, directly on the resonator, or as a separate assembly  
20 positioned on and secured with respect to the alignment substrate. The modulator enables  
21 control of the resonator, which in turn controls the optical power transmitted through the  
22 transmission optical waveguide and/or the second optical element. Structures may also be  
23 provided for suppressing undesired optical modes and/or resonances associated with resonators  
24 and/or alignment structures on the optical fiber.